

USE OF CONCEPT MAPS AS A GUIDE TO CRITICAL THINKING IN
UNDERGRADUATE NURSING STUDENTS

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Chapter I

Introduction

Nursing students today will enter an arena of complex patient acuity and changing demands in nursing practice. To meet this purpose, educators endeavor to progress students beyond the rote recall of facts into the realm of higher cognitive functioning, which is commonly called critical thinking. Critical thinking is the disciplined, intellectual process of applying skillful reasoning as a guide to belief or action (Norris & Ennis, 1989). Nurses must sort through irrelevant data and learn to focus on the important aspects of patient assessment that need priority attention. In nursing today, critical thinking is required to approach patient problems in a systematic and logical manner to ensure quality care.

Critical thinking requires motivation and a holistic view of patient care. The skills of critical thinking come into view when nurses are confronted by a problem with no obvious or immediate answer (Rogal & Young, 2008). Critical thinking abilities allow nurses to interpret, analyze, and evaluate data that reflect on their patient care.

Development of problem solving skills that require critical thinking is a goal in nursing education; however, the means to show progression in this ability remains a challenge. Concept maps can provide organization for reading assignments and classroom activities, a method of defining nurse case management, an alternative to focus

groups, and a method of studying for tests, note taking, and preparation for academic papers (Harpaz, Balik, & Ehrenfeld, 2004). Students report that learning through concept mapping encouraged them to think more independently and gave them more confidence in implementing their knowledge in the clinical area. Nurse educators reported that the use of concept mapping changes students from passive learners to active ones and improved evaluation of students' knowledge and safety in the clinical environment. The goal of using concept maps as a teaching strategy is that this format can assist students in understanding abstract material, integrate past learning with new knowledge, and assist students to progress beyond rote memorization to meaningful learning.

Nurse educators are also challenged with finding ways of evaluating critical thinking abilities in students. When criteria are established for evaluation, concept maps can be used for grading. The evaluation of a concept map assignment can easily become subjective unless clear criteria for grading is established and defined for the student. Faculty need to establish the validity and reliability of their evaluation tool for this strategy (Billings & Halstead, 2005).

One method for grading is to ask students to explain the relationships and cross-links among concepts. This could be done in short papers that accompany the concept map and then graded similar to other written assignments. In the clinical area, concept maps can be evaluated by: comprehensiveness of data assessment, if data are linked to

the correct diagnoses and problems, if nursing interventions and treatments are specific and relevant, and if the relationships among the concepts are indicated and accurate (Oermann, Saewert, Charasika, & Yarbrough, 2009). Evaluation criteria may also include content analysis or the number of items included in the map, the clarity of the organizational structure, and the way the content is categorized (Billings & Halstead, 2005). Students can self-evaluate or peer-evaluate concept maps as a way of building the professional skills of self-assessment and peer evaluation (Billings & Halstead, 2005).

Background and Significance

The development of critical thinking in nursing students is a challenge that nurse educators strive to achieve and evaluate in their academic strategies. Nursing as a career has changed from merely an occupation to that of a recognized profession, and in doing so, has progressed from task orientation to skilled professionalism based on well-developed knowledge (Martin, 2002).

Alfaro-LeFevre (1995) claims that practicing nurses and nurse educators concur that the increasing complexity of modern healthcare demands critical thinking. Nurses are continuously sorting through a great deal of patient information and data to grasp knowledge for problem identification and decision-making. These decisions are frequently concerned with situations where there is no single or absolutely correct response (Fowler, 1998). Colucciello proclaims the use of critical thinking is

vital in examining simple and complex situations in nurses' day-to-day responsibilities. It is an essential means of establishing whether the information or assessment obtained has been accurately captured in order to articulate specifically and distinctly what the information conveys (Colucciello, 1997).

Critical thinking is a composite of the ability to recognize the existence of problems, knowledge of the nature of the evidence assessed, and the skills to apply what is known (Watson & Glaser, 1980). Critical thinking can be summarized as a disciplined method to reflectively decide what to believe or what to do; in other words, making reasonable judgments. Critical thinking can also foster self-confidence and the desire for life-long learning (Scheffer & Rubenfeld, 2000). It is both a process and an outcome, using the holistic approach to the nursing process.

The skills of critical thinking can be taught, learned, and measured, but must be continually practiced and reinforced in the clinical area. Some factors which may enhance critical thinking skills are experience, self-confidence, good interpersonal skills, and good support systems such as mentoring in the clinical arena. Some factors that may impede critical thinking are stress, anxiety, dislikes and prejudices, fatigue, lack of motivation or positive reinforcement, and time restraints (Raymond & Profetto-McGrath, 2005).

Critical thinking is a reflective process focused on a purposeful goal using self-regulatory judgment (Facione, 1990). Nurses utilize critical thinking to reason and to determine professional or clinical judgment. Critical thinking in nursing is so important

that educational programs are evaluated according to the development of skills related to this ability in students. Schools of nursing are now mandated to demonstrate critical thinking skills and problem solving skills in their graduates by the National League of Nursing (NLN) for school accreditation (Kostovich, Poradzisz, Wood, & O'Brien, 2007).

Historically, nursing care plans have been utilized in nursing education to identify actual and potential health problems. The rigid structure of this format often makes it challenging for students to gather appropriate data to identify and understand the many complex problems of their patients. To promote critical thinking, improve problem-solving skills and foster understanding of the interrelationships among patient's health concerns, researchers in nursing education have suggested that the critical-thinking abilities of students could be expanded by encouraging reflective thinking through such activities as concept mapping (Hicks-Moore, 2005).

The technique of concept mapping was developed by Joseph Novak at Cornell University in the 1970s as a means of representing the emerging science knowledge of students (Novak, 1984). It has subsequently been used as a tool to increase meaningful learning in the sciences. Concept maps have their origin in the learning movement called constructivism, in which learners actively construct knowledge. Novak's work is based on the assimilation theory of Ausubel (1968), which states the importance of prior knowledge in learning new concepts. Two other important ideas that emerge

from this theory are: cognitive structure is organized hierarchically with less inclusive concepts subsumed under the more general concepts; and when meaningful learning occurs, relationships between concepts become more explicit, more precise, and better integrated. Concept maps have been developed specifically to encompass a learner's cognitive structure and to evaluate what the learner already knows.

Statement of Problem

Nursing educators must show evidence of critical thinking and judgment in their student's progression for their program accreditation. Finding appropriate teaching tools and strategies to accomplish this goal has been an ongoing challenge. The use of concept mapping may be one educational strategy to aid in developing significant learning in the nursing curriculum. The concept map method may also be useful in evaluating the progression of higher cognitive skills in undergraduate nursing students.

Purpose of the Study

The purpose of this study was to evaluate the use of concepts maps as a teaching technique that illustrates the progression of critical thinking skills in undergraduate nursing students in a critical care course using case study scenarios. This study is a modified replication of Wilgis and McConnell's (2008) study.

Research Questions

1. Is concept mapping effective as a teaching tool in developing critical thinking over a semester in undergraduate nursing students enrolled in a critical care nursing course?

2. Is concept mapping an effective analytical tool to help nursing students prioritize, synthesize, and organize data in a logical manner to enhance critical thinking?

Theoretical Framework

There are a number of nursing models or conceptual frameworks that relate to critical thinking. These theoretical frameworks or models can be linked to critical thinking based on the definition. Nursing models provide a perspective of the patient being cared for, specifies the approach to be taken in the delivery of care, and structures critical thinking, reasoning, and decision making in practice (Fawcett & Alligood, 2005). Nurses use critical thinking skills to apply the models and theories to their patient's health concerns.

One of these models is Benner's Novice to Expert theory that identifies five stages graduate nurses progress through to develop and refine critical thinking abilities. This transition is considered essential to professional development and each stage is characterized by growth in critical thinking knowledge and clinical knowledge (Benner, 1984). Another model is the T.H.I.N.K. model by Rubenfeld and Scheffer (1995) that emphasizes various modes of thinking and the need for synergy among the modes. Videbeck's (1997) model integrates critical thinking in all aspects of the nursing program curriculum, including definition, course objectives, and evaluation. Kataoka-Yahiro and Saylor (1994) proposed the Critical Thinking Model for Nursing Judgment which specifies five components: specific knowledge base, experience, competencies, attitudes,

and standards. Bandman and Bandman (1995) identified a model that specifies critical thinking functions in a checklist format; using critical thinking for analyzing issues into premises and conclusions, examining nursing assumptions, verifying, corroborating, justifying claims and conclusions, formulating value judgments, and evaluating the soundness of conclusions; these reflect the relationship between critical thinking and clinical judgment. Critical thinking incorporates ideas from nursing models with clinical experience and provides the structure for unique and creative nursing practice.

Definition of Terms

Critical Thinking

There have been many definitions of critical thinking in the literature. Norris and Ennis define critical thinking as the disciplined, intellectual process of applying skillful reasoning as a guide to belief or action (Norris & Ennis, 1989). Watson and Glaser view critical thinking as being more than a specific set of cognitive skills – a composite of skills, knowledge and attitudes (Watson & Glaser, 1980). Critical thinking is a process for reasoning which anyone has the capacity to master, proposing that such a reasoning process will provide nurses with a capacity to defend their actions (Ulsenheimer, Bailey, McCullough, Thornton, & Warden, 1997). Miller and Babcock (1996) describe critical thinking as purposeful thinking that takes into consideration focus, frame of reference or context, evidence, facts, attitudes, assumptions, reasoning, conclusions, and implications emphasizing the context in which critical thinking occurs.

The need for a universal definition of the term critical thinking led nurse scholars to the formation of the Delphi Project from the American Philosophical Association in 1989. The panel of experts involved in this project formed a consensus in relation to the concept of critical thinking intended to guide curriculum development, instruction, and assessment. The final definition of critical thinking from the report follows:

“We understand critical thinking to be purposeful, self-regulatory judgment which results in interpretation, analysis, evaluation and inference as well as explanation of the evidential conceptual, methodological, criteriological or contextual considerations upon which that judgment was based. Critical thinking is essential as a tool of inquiry. Critical thinking is a pervasive and self-rectifying human phenomenon. The ideal critical thinker is habitually inquisitive, well-informed, honest in facing personal biases, prudent in making judgments, willing to consider, clear about issues, orderly in complex matters, diligent in seeking relevant information, reasonable in selection of criteria, focused in inquiry and persistent in seeking results which are as precise as the subject and the circumstances of inquiry permit” (Facione, 1990, p.4).

The panel also identified and defined 10 habits of the mind, the affective components, and 7 skills, the cognitive components, of critical thinking in the area of nursing. The habits of the mind of critical thinking in nursing include: confidence, contextual perspective, creativity, flexibility, inquisitiveness, intellectual integrity,

intuition, open-mindedness, perseverance, and reflection. Skills of critical thinking in nursing include: analyzing, applying standards, discriminating, information seeking, logical reasoning, predicting, and transforming knowledge (Scheffer & Rubenfeld, 2000). These findings can be used to understand the essential role of critical thinking in nursing education.

Concept maps

Concept maps are tools for organizing and representing ideas. Concepts maps are defined as schematic drawings or methods that represent meanings of concepts embedded in a framework of propositions. Concept maps include ideas, usually enclosed in boxes or circles, and relationships between concepts, usually indicated by a connecting line, arrow, or linking word. There are two features of concept maps that are important in the facilitation of critical thinking: the hierarchical structure and ability to characterize the cross-links (Schuster, 2000).

A concept map is a specific method to visualize an individual's knowledge about a distinct topic. It can reveal patterns and relationships among concepts in a visual arrangement. One of the reasons concept mapping is so powerful to promote meaningful learning is that it serves as a kind of template to help organize knowledge and create structure. Many students and educators are surprised to see how this simple tool facilitates thoughtful learning and the retention of the knowledge for long periods of time (Novak, 1990).

There are various types of concept maps such as: spider maps, which are organized around a unifying factor or concept with subthemes radiating outward; hierarchy maps, where the most important information is prioritized at the top of the map and subcategories cascade toward the bottom in order of importance similar to algorithms used in health care; flow charts, where information is ordered in a linear format; system maps, where information is organized similar to a flow chart and inputs and outputs are added; pictorial landscape format maps, which use a pictorial representation to organize and define information; multidimensional maps, which use pyramids, cubes, or other geometric shapes to demonstrate the complexity or flow of information; and mandala maps, which present information in the form of overlapping or interlinking shapes that can focus attention to a specific area (All, Huycke, & Fisher, 2003). A unique feature is that each map represents an individual's personal interpretation of the meaning for the patient data; and therefore, no two maps are alike.

Limitations

The findings from this study were limited in generalization because of a small convenience sample selection and the potential threat to internal validity due to the pretest/posttest design. It may be difficult to assess whether the findings actually indicate differences in critical thinking or progressing efficiency in the construction of the concept map design.

Assumptions

This small descriptive comparison study was grounded by the following assumptions:

1. Cognitive functions can be developed through specific educational strategies.
2. Undergraduate nurses are not critical thinkers at the beginning stage of their nursing education.
3. Critical thinking is essential for proficient nursing care.
4. Concept mapping is a method of evaluating the process of critical thinking.
5. Critical thinking abilities are learned and improved with practice.

Summary

Nursing is a complex mixture of academic and practical skill unification which requires the effective integration of theory to practice. Concept maps represent a clear picture of what students are thinking and shown to be a successful strategy to use in both the classroom and clinical area. By having students use information in concept maps for patients they actually provide care for in the clinical setting, faculty can evaluate their ability to identify priority data and relationships between conditions and associated care.

Chapter II

Literature Review

Introduction

Critical thinking is viewed as an essential component for nurses; and an attribute which separates the professional nurse from a purely technical one. The American Nursing Association (ANA) Standards has set the framework necessary for critical thinking in the application of the nursing process (ANA, 2003). It is still the accepted practice of nurses to perform intuitive nursing; however, when this is done in a manner that is an automatic routine and without vigilance and care, the results can have significant negative consequences. Students develop intuitive thinking skills by first learning the tools of critical thinking and then applying them consistently in their clinical experiences. Teaching nursing students how to think critically when planning patient care is essential to their professional success.

One tool gaining momentum in nursing education is that of concept mapping. The use of concept mapping is an alternative to the traditional nursing care plan. To be effective in their nursing practice, students need to organize patient data and connect this information to previously acquired knowledge in a meaningful manner.

Concept mapping is a teaching strategy that assists nursing educators in promoting critical thinking skills (Roop, 2002). This method of visual presentation allows students to draw the necessary connections among key concepts in their assessment data and correlate the resulting complex relationships. Concept maps, as an alternative to traditional care plans, may enhance learning when they are used to summarize information and may foster critical thinking and improved clinical preparedness.

Organization of Literature

The literature review focused on selected studies associated with critical thinking and teaching strategies, specifically concept mapping in nursing education. The review chapter consists of the following four sections. The first section included a description of the theoretical framework. The supportive literature was divided into the following three sections: critical thinking, assessment of critical thinking, and critical thinking and concept mapping. A summary concludes the chapter.

Theoretical Framework

Patricia Benner's (1984) "From Novice to Expert" theory was the framework for this study. Inexperienced nurses must deal with a wide variety of complex situations and conditions, many of which they are seeing for the first time. The five levels of nursing experience, novice, advanced beginner, competent, proficient, and expert, were described in the mid-range theory. This mid-range theory reflects the concept that expert nurses develop skills and understanding of patient care over time through a sound educational base as well as a multitude of experiences.

Benner's stages of clinical competence was based on the Dreyfus Model of Skill Acquisition (Dreyfus & Dreyfus, 1980), which can be generalized to nursing.

Benner, Tanner, and Chesla (1992) observed that professional advancement along a hierarchy of thinking, judgment, behavior, and experience differentiated one level of practice from another. Nurses who were at different levels of skills acquisition literally live in different clinical worlds. These different levels reflected changes in three aspects of skilled performance. The first change was a movement from reliance on abstract principles to the use of past concrete experience as paradigms. The second change reflected the learner's perception of the situation and its demands, which this was seen less as a compilation of relevant pieces and more as a complete whole in which certain aspects are relevant. The third change was a passage from detached observation to that of involved performer, thoroughly engaged in the situation (Benner et al., 1992).

The novice nurse enters the profession with a rather rigid textbook idea of approaching patient care situations, with little or no experience as a guide. With the acquiring of enough real-life experience, the nurse moves into the advanced beginner stage, where gathering and interpreting information comes in both the objective and subjective manner. Nurses in this stage move slowly from rote application of principles to integrative thinking and prioritization of patient care. The competent nurse consciously integrates abstract information and establishes a perspective to manage care in a timely and organized manner. The nurse becomes proficient by perceiving a situation in a holistic perspective and possessing an increased level of critical thinking

and decision-making skills. The expert nurse intuitively grasps the predominant issues of a clinical situation and acts without experimenting along a continuum of possible solutions. An attribute of an expert nurse is one who uses mindful practice to reflect upon one's skilled nursing care practices, decisions made and patient-family-health care team interactions. Progression through these levels of proficiency mirrors the development of knowledge (Benner et al., 1992).

Benner's (1984) model has good use as a prototype for developing educational strategies with an emphasis on holistic clinical nursing, an educational objective. It also highlights the need for excellence in practice while not losing sight of the core value of caring for patients. Identifying concepts under categories is not the same as productive or critical thinking, although this is an important strategy for organizing and managing information. The process begins with learning the fundamental skills of nursing care while applying the sound principles of nursing. Students must progress to forming critical thinking abilities in finding solutions to complex problems in patient care situations. The transition from theory to practice by gaining hands-on experience is an important step for the nurse in the process of becoming more adept. Perception and problem-solving are intimately related. Helping students obtain good critical thinking and decision-making skills in the intellectual, interpersonal, and technological arenas will assist them in moving through Benner's levels more readily. Benner integrates learning and development into one reliable research based framework

that is well suited for understanding and promoting both individual and organizational learning about practice in nursing education.

Critical Thinking

The profession of nursing has long debated over the definition of critical thinking. The term is often interchanged with reflective problem solving to further define the cognitive processes involved in this type of reasoning. The working definition of critical thinking was derived from a panel of 46 experts using the Delphi method in the late 1980s: "We understand critical thinking to be purposeful, self-regulatory judgment that results in interpretation, analysis, evaluation and inference, as well as explanation of the evidential, conceptual, methodological, criteriological, or contextual considerations upon which that judgment is based." (Facione, 1990, p. 2). Critical thinking is, thus, a judgment process. The goal of critical thinking is to decide what to do in a given context, in relation to the evidence assessed, using appropriate methods and evaluation by standard protocols.

The critical thinking definition work of the late 1980s was the basis for relating the concept to the nursing process. Teaching critical thinking in the basic nursing curriculum requires building analytical skills along with knowledge of core components of nursing practice (Dickerson, 2005). This process of observation, reasoning through knowledge and experience, and critical thinking leads to the concept of clinical judgment. Clinical judgment is the conclusion or enlightened opinion at which a nurse arrives

following a process of observation, reflection and analysis of observable or available information or data (Phaneuf, 2008). This concept, however, can be difficult to put into practice, and may explain why student nurses have difficulty in mastering this essential skill. Nurses process vast amounts of critical information in their contacts with patients and require well-reasoned assessments to develop clear and precise judgments about their nursing decisions and interventions. Much of the literature has focused on critical thinking in the outcomes of learning rather than in the development of the processes involved (Tanner, 2006).

There have been many disciplines debating the definition of critical thinking and clinical judgment for over a quarter of a century. College-level courses have been developed to enhance student's critical thinking skills but there has been a lack of consensus on the definition and the measurement of the critical thinking process. In regards to the specific discipline of nursing, Gordon (2000) developed a study to compare definitions of critical thinking by nurse educators and non-nurse scholars. This diversity of definitions, skills, and characteristics of critical thinking prompted the investigation whether nurse educators and non-nurse educators held common perceptions about this concept. Research areas explored included nurse educators' perceptions of critical thinking compared with non-nurse scholars, perception of critical thinking concept agreement among nurse educators teaching in baccalaureate nursing programs, and nurse educators' perceptions of critical thinking congruency with conceptualization of critical thinking in the nursing literature.

Gordon (2000) used a descriptive design in this exploratory study. The instrument used to gather data was a researcher-developed questionnaire based on a survey described in earlier literature and the description of critical thinking skills, dispositions, and concepts identified by the Facione Delphi study. Content validity and construct validity were established for this instrument as well as reliability by eight masters prepared nurse educators over a two-week period.

The research sample for this comparison was gathered using a cluster sampling technique of 201 baccalaureate nurse educators from 83 schools randomly selected in the Midwest region as described by the National League of Nursing. Questionnaire packets were distributed to these schools with a 51% return rate. Results indicated faculty had a wide range of nursing teaching experience, with 14% having less than 5 years experience and 13% having over 25 years teaching experience. Faculty expressed their own perception of critical thinking was developed by having discussions with other nursing faculty (80%), reading about critical thinking in professional nursing journals (81%), and attending conferences on critical thinking (73%). Only 36% reported reading non-nursing journals to expand understanding of critical thinking (Gordon, 2000).

Results of the questionnaire showed that nurse educators perceived skills associated with analysis, evaluation, and inference as critical-thinking skills (91%). Using Chi-square, the nurse educators were less likely ($p < 0.05$) than the non-nurse educators in considering skills associated with interpretation, explanation, and self-

regulation as critical-thinking skills. There was no significant difference ($p>0.05$) by years of teaching experience or type of educational preparation. The nurse educators perceived critical thinking as an abstract, generalized, learnable, rational process, synonymous with clinical decision-making or problem-solving (Gordon, 2000).

Nurse educators were more likely to identify problem-solving, researching, and decision-making as components of critical thinking, and less likely to agree with the expert panel of non-nurse educators to include interpretation as a critical thinking skill, even though interpretation was a crucial component of the nursing process and clinical judgment. This study confirmed that nurse educators view the concepts of critical thinking differently than the non-nurse educators in various disciplines. This research also emphasized the importance of developing meaningful definitions for concepts. Gordon (2000) concluded it was important for nurse educators and non-nurse scholars to have a similar understanding of critical thinking and the means to measure these critical thinking skills.

Assessment of Critical Thinking

If the nursing educational system is primarily responsible for the development of critical thinking skills needed in practice, how do we assess the role of nursing faculty in this area? To address this question, Zygmunt and Schaefer (2006) investigated the critical thinking skills of the faculty in an undergraduate nursing program. Purposes of this study were to determine the critical thinking skills of the faculty and examine the

relationship between the faculty's understanding of nursing knowledge and the critical thinking skills of analysis, inference, evaluation, and inductive and deductive reasoning.

Using a descriptive correlation design, the study included a random national sampling of 300 full-time nursing faculty from the National League of Nursing schools. Most faculty (81.1%) had dual responsibility for both classroom and clinical instruction. All types of nursing education programs were included (Zygmunt & Schaefer, 2006).

Data was collected with the California Critical Thinking Skills Test (CCTST) and the Learning Environment Preferences (LEP), along with a demographic questionnaire. The CCTST was used to measure the critical thinking skills of the faculty and included a separate score for each of the five subscales of the instrument, analysis, evaluation, inference, deductive reasoning, and inductive reasoning. The LEP assessed the individual's learning environment preference as an indication of the understanding of knowledge as either static and absolute or relative and situational. This instrument was chosen for its focus on components of the educational process and ease of completion (Zygmunt & Schaefer, 2006).

Results from the CCTST data indicated that faculty varied considerably in their ability to think critically. This data was then analyzed for correlations between the CCTST and demographic questionnaire. Findings revealed a low, negative correlation between age of the faculty and evaluation subscale of the CCTST ($r = -.289, p < .04$). Analysis of the LEP indicated that no faculty viewed their knowledge as absolute or dualistic; however, no faculty achieved a score indicative of critical thinking.

Again, comparing this instrument with the demographics showed negative correlations for years of teaching and education in critical thinking. Most faculty (78.4%) reported having received no education on critical thinking themselves (Zygmunt & Schaefer, 2006).

Following were major conclusions from the study. Critical thinking may involve an ongoing process over time. Development of critical thinking may require experience as well as education. Students taught by faculty not skilled in critical thinking may be at a disadvantage in developing the skills needed for critical thinking in the work environment. There was a relationship between the ability of the nursing faculty to engage in critical thinking and the ability of the learner to achieve these skills (Zygmunt & Schaefer, 2006).

Zygmunt & Schaefer (2006) formulated a number of recommendations from the research. One recommendation was that an emphasis needed to be placed on how the learner understands and thinks about content rather than the teacher teaching and covering content. The researchers also recommended the development of active critical thinking skills through assignments that require imagination and reflective thinking. Finally, the researchers emphasized creating an environment where inquisitiveness and thinking “out of the box” could foster the acquisition of critical thinking skills and should be encouraged in both the clinical and classroom settings.

Another study focused on the assessment of critical thinking through the perception of faculty. Twibell, Ryan, and Hermiz (2003) investigated the perceptions of

faculty teaching critical thinking skills through a number of approaches. The purpose of this study was to explore the perceptions of nursing faculty members as they teach critical thinking skills to baccalaureate students in clinical settings. The researchers used as their concept the definition of critical thinking by Alfaro-LeFevre and the definition of critical thinking that emerged from the Delphi study by Scheffer and Rubenfeld.

This study used an ethnographic qualitative design to explore faculty members' perceptions related to the teaching of critical thinking skills in clinical settings. A multiple case study approach was implemented to examine these perceptions. The setting was a public school of nursing in the Midwest and the sample was comprised of six clinical nursing instructors, all women, ranging in age from 40 to 55 years. Criteria for inclusion in this sample were nursing clinical teaching experience of at least five years and one year teaching experience at the baccalaureate level. The participants all taught the upper level baccalaureate students, increasing the likelihood that these students had some basic knowledge in order to develop critical thinking skills (Twibell, Ryan, & Hermiz, 2003).

Data for this study was collected using personal interviews, which were done three times during the semester at two week intervals, shortly after a clinical experience with students. These interviews were audio-taped, transcribed, and analyzed. Some research questions asked faculty to describe students' words that related progress in critical thinking, describe their actions or words that may have directed students' critical thinking, and describe characteristics of their instruction that may have stimulated or

supported the development of critical thinking in their students. Rigor was ensured by one researcher conducting all the interviews, two researchers analyzing the data individually without collaboration, and a reflective journal kept by the lead researcher to evaluate dependability (Twibell, Ryan, & Hermiz, 2003).

Data analysis was guided by a developmental research sequence. Results emerged into the following five domains: putting it all together, strategies to promote critical thinking, role of clinical instructors, beneficial characteristics of clinical instructors, and rewards for critical thinking. The authors focused on the first two of these domains as the narrative descriptions were of the strongest consensus in these areas. The participants agreed that students who think critically must move past the initial superficial information of the clinical situation, reflect on their experiences, assign meaning, problem solve, predict outcome, and plan what to do next. Strategies that instructors may find useful in promoting critical thinking in this setting is that of questioning, written assignments, clinical conferences, and journaling. The faculty agreed these four primary teaching strategies could be used to describe student progression of critical thinking skills in the clinical area (Twibell, Ryan, & Hermiz, 2003).

Although this study was limited by the small number of participants in the sample, some ideas for teaching strategies were presented. Teaching strategies that emerged were: knowing how to pose questions to stimulate higher-order cognitive processes, the use of case studies in clinical conferences to encourage discussion, role

playing, and the examination of alternative approaches to practice situations, and the use of journaling for self reflection and insight. Further study was suggested in the area of critical thinking measurement validity and reliability (Twibell, Ryan, & Hermiz, 2003).

Critical thinking in undergraduate nursing education has been widely explored in earlier literature; however, no systematic evaluation of changes in critical thinking skills that occur during graduate education has been reported. McMullen & McMullen (2009) investigated the critical thinking skills of advanced practice nurses to assess patterns of growth over time in these abilities. The purpose of this study was to determine how critical thinking skills change during a 2-year graduate nurse program. The conceptual model was the definition of critical thinking using the Delphi method and individual growth modeling. The assumption indicated in the descriptive statistical design study that critical thinking abilities were learned and improve with practice (McMullen & McMullen, 2009).

A successive independent sample design was used. The sample consisted of 82 female nursing students entering a 2-year graduate nurse practitioner (NP) program. The average age of the participants was 37.9 years ($SD = 8.10$, range = 26 to 57); average grade point (GPA) was 3.3 ($SD = 0.48$, range = 2.80 to 3.91); and average time working as a registered nurse (RN) was 13.9 years ($SD = 9.07$, range = 2 to 36) (McMullen & McMullen, 2009).

The data consisted of repeated measures of critical thinking using the California Critical Thinking Skills Test (CCTST). This 34 multiple-choice questionnaire has three subscale scores of evaluation, inference, and analysis. Construct and content validity was based on the definition of critical thinking developed by the Delphi study. The Kuder-Richardson 20 internal consistency reliability measure for the CCTST ranged from 0.68 to 0.70. The researchers analyzed individual growth modeling by gathering data regarding within-person changes and between-person changes (McMullen & McMullen, 2009).

Results indicated all three critical thinking initial status estimates were significant ($p < 0.001$), meaning that for the average student, critical thinking skills varied during the 2-year graduate nursing education program. At program entry, students with a higher initial level of evaluation skills showed a slight increase ($<6\%$); however, students at the 25th percentile or below at program entry demonstrated a 54% increase in their evaluation skills during the 2-year program. Students around the median or above for inference skills at program entry showed a stable growth trajectory; those students at the 25th percentile or below exhibited an improvement of 1.8 points in their skill level. Analysis growth model depicted change as a linear function of the time of students' participation in the program. There was a three-point difference in analytic skills at the beginning of the program and a one-point difference by the end of the program. A comparison of the within-person and between-person variance revealed a significant decline ($p < 0.05$) from

2.006 to 1.366 for evaluation, from 1.482 to 1.293 for inference, and from 1.700 to 1.168 for analysis (McMullen & McMullen, 2009).

Findings indicated that growth in critical thinking skills varies and depends on the level of skills each student brought into the program. Analysis was also demonstrated to be a more complex operation than inference and evaluation because analysis requires the mapping of relationships among statements previously identified and assessed.

Additional support in this area was recommended by the researchers to maintain higher analytic skills. The researchers concluded the ability of nurse educators to differentiate patterns of individual growth at different levels of competence and expertise would allow for educational programs to better meet the needs of students (McMullen & McMullen, 2009).

Nursing's challenge is to define, measure, and examine the relationship between critical thinking and clinical competence. The National League of Nursing (NLN) requires that critical thinking be a criterion to evaluate the effectiveness of nursing educational programs. May, Edell, Butell, Doughty, and Langford (1999) tested the relationship between critical thinking skills and clinical competence. Purposes of the study were to describe one school of nursing's experience in defining, measuring, and relating critical thinking and clinical competence. The authors used the concept of clinical competence and the five stages of nursing proficiency as described by Benner. The sample consisted of 143 baccalaureate senior nursing students from a small, northwestern liberal arts college. The average student was 28 years old, female, white,

working part-time, spoke English as the primary language, and had no children (May et al., 1999).

A descriptive and exploratory design was used for this study. Two instruments were implemented for data collection; the California Critical Thinking Dispositions Inventory (CCTDI), a 34 item tool to test cognitive skills, and the California Critical Thinking Cognitive Skills Test (CCTCST), a 75 item tool to measure the dispositions of critical thinking. The reliability for the CCTDI was Cronbach's alpha reliability of .70 and was set at .90 for the CCTCST instrument. Students were also evaluated at the end of their senior year using a Likert-type scale developed by the faculty of this institution as a means of quantifying clinical competency outcomes. This tool used a range of 0 to 4 (0 = never meets competency to 4 = meets competency all the time) and had a minimum average score of 2.5 required to meet the standard (May et al., 1999).

Findings from the CCTDI showed that 85% of the students scored equal to or above the mean score of 280, with a range of 238 to 377. The CCTCST scores of the students revealed a mean score of 16.76, exceeding the established mean of 15.89, with a range of 8 to 28. These findings are consistent with other research studies in this area. The faculty's clinical competence evaluation tool revealed acceptable scores, with every student meeting the minimum standard of 2.5, with a mean score of 3.58. When correlating the clinical competency and critical thinking scores, no statistically significant relationships ($p < .05$) were demonstrated. Pearson product-moment correlation values

showed little relationship between critical thinking and clinical competence scores.

There were few positive relationships which approached statistical significance between the CCTCST, CCTDI, and the clinical competency scores. First, the critical thinking clinical competency criterion had a positive correlation with the CCTDI open-mindedness and truth-seeking dispositions as rated by the clinical instructors ($r = .173$, $p < .05$ and $r = .206$, $p < .05$, respectively). Second, students' ability to apply ethical, legal, cultural, and professional values to their nursing care correlated positively with CCTDI inquisitiveness, as rated by the preceptors and students ($r = .185$, $p < .05$ and $r = .170$, $p < .05$, respectively) (May et al., 1999).

While this study failed to establish a positive correlation between critical thinking and clinical competence, it did demonstrate the usefulness of the CCTDI and CCTCST tools in providing quantitative information regarding these abilities in students and the effectiveness of the nursing program. An explanation as to the lack of correlation between critical thinking and clinical competency might be that the tools used, the CCTCST, CCTDI, and the clinical competency evaluation, may not be reliable in explaining this relationship. Also, May et al. (1999) suggested some researchers proposed that critical thinking is a process rather than an outcome, thus using outcome measures, such as they had in their research. The researchers also felt, as Benner proposed earlier, the concept of critical thinking might not be apparent at the novice stage. The researchers recommended that the relationship between critical thinking and

clinical competency be studied at six months post-graduation, when graduates have “real-world” experience as RNs (May et al., 1999).

Nurses are faced with more complicated decision-making as the growth of nursing practice becomes more autonomous and health care systems become more complex. In the area of critical care nursing, these decisions are often needed to be made quickly. For this purpose, Rogal and Young (2008) used their study to examine if the critical thinking skills of critical care nurses enrolled in a postgraduate critical care course improved over time and to compare their scores with normative data using the California Critical Thinking Skills Test (CCTST). The scores were evaluated using protocol established by the CCTST. This tool consists of 34 multiple-choice questions covering five subscales: analysis, evaluation, inference, inductive reasoning, and deductive reasoning.

The course was a 12 month, full-time course accredited through the school of nursing in Perth, Australia and offered to graduate nurses specializing in critical care. The pilot study included 31 registered nurses enrolled in this course between 2005 and 2006. The nurses were predominately female (83.9%), with 5.5 years (SD = 4.0 years) of general nursing experience, and 2.3 years (SD = 2.8 years) of critical care nursing experience. During the first week, a 45-minute pre-test was administered; and a 45-minute post-test was given at the course conclusion. Descriptive and inferential statistics (paired *t* tests) were used to analyze the data (Rogal & Young, 2008).

The CCTST showed a mean score of 18.5 at the beginning of the course with pre-test scores ranging from 5 to 29 (SD = 5.1). The post-test mean was 19.7 with a range of 7 to 32. No significant difference was noted between pre-test and post-test total scores of these nurses ($t [df = 29], -0.733; p = .466$). Comparison with the normative scores (fourth-year college students) showed a higher range for the graduate critical care nurses. All five subscales of the CCTST increased scores at post-test and were higher than the normative group; however, no significant difference was noted between pre-test and post-test subscale scores in this nursing group. Results showed a slight improvement over time in mean critical-thinking scores. Specifically, more than half (58%; $n = 16$) of the participating nurses showed improvement in their critical thinking skills (Rogal & Young, 2008).

Although this was a small sample study, the majority of the postgraduate nurses improved their critical thinking skills during the course. While it is clear that advanced cognitive skills, such as reflective thinking and complex problem strategies, are necessary to manage patients in today's health care environment, the amount of time and experience needed to develop these skills may require various interventions, such as ongoing educational courses and staff mentoring, to facilitate the development of the clinical judgment discipline. Since the progression of critical thinking skills is complex, the researchers concluded that postgraduate courses, such as the one presented in this study, could encourage the ongoing development and improvement of critical thinking skills to promote effective clinical judgment in nurses providing advanced nursing care. Nursing

educators were encouraged to use an objective tool, such as the CCTST, to evaluate their ongoing educational programs (Rogal & Young, 2008).

Critical Thinking and Concept Mapping

On the undergraduate nursing level, strategies to teach critical thinking skills to students are varied. A growing concern among educators in nursing programs relates to methods that correctly evaluate the ability of the student to think in a meta-cognitive manner and assess their structural knowledge. One teaching strategy examined was Daley, Shaw, Balistrieri, Glasenapp, and Piacentine (1999) study of concept maps used as a method to teach and evaluate critical thinking.

The purpose of this study was to describe the methodology of concept maps to teach and evaluate students' critical thinking skills. Nursing education has focused emphasis on outcomes criteria, as required by the NLN, and evaluating critical thinking abilities in students has increased in importance. The framework for the study was Ausubel's assimilation theory of learning. This theory advocates learners to move away from behavioral strategies and embrace the cognitive learning strategies (Ausubel, 1968).

The researchers investigated three areas related to critical thinking and concept maps: use of concept maps to teach and evaluate critical thinking in nursing education, ability of concept maps to measure changes in students' critical-thinking abilities over the course of a semester, and evaluation of the use of concept maps in nursing education.

The sample consisted of six senior clinical groups (n = 54) who were taught how to use

concept maps in their first week of class. The students then completed three concept maps over the course of the semester in the clinical setting. These maps were used as discussion tools in the clinical post-conferences. The first and final maps of the semester were scored using a formula based on assimilation theory. Reliability was established by obtaining two independent scores on each concept map. Correlation between the two independent scores equaled .82 and content validity was validated by two educational researchers who reviewed the theoretical premise underlying concept maps in relation to the APA definition of critical thinking. Students and faculty were also given evaluation forms for their opinions of concept maps as a learning strategy (Daley et al., 1999a).

Data analysis showed results of a group mean score of 40.38 on the first concept map and 135.55 on the final concept map, a difference of 98.16; with a t value of -5.69 ($p = .001$) when comparing the first concept map to the final one. This data indicated a statistically significant difference between the first and final concept maps, indicative of the students' increase of conceptual and critical thinking abilities. The student evaluation of concept maps showed mixed reviews. Some comments by the students indicated the amount of in-depth preparation required and the difficulty of putting the relationships between concepts on paper. The faculty evaluations revealed that concept maps were beneficial in assessing the progression of students' critical thinking skills over the semester. These tools assisted the instructors in seeing the development of students' thinking processes and how well students had prepared for their clinical time. This

tool also allowed the instructors to correct any misperceptions the students had in their knowledge base (Daley et al., 1999a).

Daley et al. (1999b) concluded that the study demonstrated that concept maps do improve students' critical thinking abilities. The researchers indicated the results also pointed out that progression in critical-thinking skills did develop and change over a semester course using concept maps as an educational and evaluation strategy. Concept maps served as an outcome measure of the critical thinking process and as an evaluation tool with a direct link to the APA definition of critical thinking. By using concept maps, students can develop the ability to look at their nursing practice through the conceptualization of client problems and shape purposeful clinical judgments and interventions based on these criteria.

Concept maps provide students with structural knowledge and act as a visual representation of the students' ability to organize and analyze data. Nurse educators acknowledge that students have individual learning styles and preferences in acquiring knowledge and transforming it into meaningful conceptualization for their nursing practice. Kostovich, et al. (2007) addressed the issue of learning styles in their study by questioning whether a particular learning style is an indicator of aptitude in developing concept maps. The ability to think critically is essential in the complex world of nursing practice today and developing this skill requires multiple and innovative approaches by the educational team. One method of progression in this process has been the use of

concept maps. They have been incorporated in a variety of settings at different levels of the nursing program.

The purpose of this study was to investigate learning style preference and student aptitude for concept maps. The framework used was that of Ausubel's assimilation theory ((Kostovich, et al., 2007).

This correlational, descriptive study was conducted at a private university in the mid-western United States. The sample was 120 students, in the undergraduate nursing program, enrolled in either their junior or senior level adult medical-surgical nursing course. The population consisted of 96% women and 4% men with 41% from minority communities. The majority of students lived off campus, worked part-time while in school, and were age 23 years and older (Kostovich et al., 2007).

Two instruments were used for data collection. The first instrument was the Learning Style Survey (LSS), an adaptation of Kolb's (1976) Learning Style Inventory (LSI). No literature supported the reliability and validity of this tool in previous research. Internal reliability of the subscale scores for the LSS was low; and test-retest reliability data was obtained from 13 students. Correlations between the subscales scores on test-retest were moderately strong (0.59 to 0.77) and statistically significant ($p < 0.05$) for the subscales. Validity of the LSS was supported by negative correlations between the subscales ($r = -0.26$, $p < 0.01$) ((Kostovich et al., 2007).

The second instrument was developed by the researchers and consisted of nine open-ended questions related to preferences for creating concept maps. Prior to the

creation of concept maps, students were instructed to include elements of pathophysiology, nursing diagnoses, treatment and interventions, diagnostic tests, and clinical manifestations. Concept maps were evaluated on hierarchy, propositions, cross-links, and thoroughness (Kostovich et al., 2007).

Results revealed a mean concept map grade of 89.98 (SD = 9.15), with the final grade for the course being 82.68 (SD = 7.04). Concept map and final course grades were weakly correlated ($r = 0.37$, $p < 0.01$). One-way ANOVA was used to examine the influence of learning preference on concept map grades; the difference was not significantly higher [$F(3, 75) = 0.921$, $p = 0.435$]. Qualitative data on the survey showed that the students in the abstract learning preference group preferred concept maps to case studies; no other distinct preferences were noted (Kostovich et al., 2007).

Findings indicated that learning style preferences did not play a role in students' ability to perform well on concept maps. The researchers indicated findings suggested that the use of concept maps challenge students to expand their patient care approach in new and unfamiliar areas. The reliability and validity of the LSS instrument was cited as a study limitation. The researchers also recommended research to confirm the use of concept maps as a teaching strategy that is not dependent on a particular learning style preference (Kostovich et al., 2007).

Another study that looked at the evaluation of concept mapping as a reflection of the critical thinking process in developing competent practice was that of Abel and

Freeze's (2006) research done in an associate degree nursing program. The purpose of this study was to evaluate concept mapping as a clinical teaching-learning activity that reflects critical thinking by identifying complex relationships among the components of the nursing care plan (Abel & Freeze, 2006).

Incorporated into their framework, the researchers cited the APA definition of critical thinking which describes the concept of critical thinking as a nonlinear process of purposeful, self-regulatory judgment that gives reasoned consideration of evidence, contexts, conceptualizations, methods, and criteria. The framework also used Daley's (1999) study which examined how students utilized concept mapping to apply theoretical knowledge in their clinical practice. The study investigated three issues: the use of a concept map to demonstrate critical thinking and use of the nursing process the care of hospitalized clients, the ability of concept map use to measure changes in critical-thinking over time, and the evaluation of concept map use as a clinical learning activity (Abel & Freeze, 2006).

This study assessed critical thinking abilities by using concept maps based on nursing process. Assumptions included nursing process components are consistent with critical thinking, the nursing process uses critical thinking for synthesis identification and description of client needs, nursing care, and relationships among components, and a nursing care concept map graphically illustrates the flow of linear and nonlinear thinking involved in the nursing process (Abel & Freeze, 2006).

The sample consisted of 28 associate degree nursing students from one class. Participants included 24 Caucasian, 2 African-American, 1 Hispanic, and 1 Asian with an age range of 21 to 43 years (mean age 28). Twenty-five students were women and 3 were men. The design of the study required each student to complete a one-page concept map in the second semester, the fourth semester, and two concept maps in the fifth and final semester. Each completed concept map received a numerical score, which demonstrated the student's ability to identify and describe clients' needs, nursing care, and relevant relationships. Cross-link scores on the concept maps indicated the student's ability to use nonlinear thinking skills to identify relationships among segments of the hierarchies and synthesis of current and previous knowledge, using nursing process as a framework. Interrater reliability was established in a pilot study using the same scoring criteria by the same instructors. Intrarater reliability was determined by random selection of two maps previously scored by each instructor. The content validity for the scoring criteria was established by an earlier study (Abel & Freeze, 2006).

Results from this study showed total scores for the concepts maps in the second semester to be 241, and in the maps completed in the fifth semester, the scores were 373. Cross-link scores, which reflected meaningful relationships among concepts, were 140 in the second semester and 260 in the fifth semester. Mean scores increased each semester and a paired *t*-test was - 4.75, critical *t* value with 27 df was 1.70 ($p = 0.05$), which indicated a statistically significant difference between the scores of the first and the last maps completed by the students (Abel & Freeze, 2006).

The researchers concluded the total map scores indicated that the students had been able to identify both psychosocial and physiological needs of their clients and relate to the appropriate nursing care. They felt nonlinear thinking was evident in the cross-links of the map and the increased number of cross-links noted in the later maps indicated a better understanding of relationships among the various components of the client's care. Findings supported that the use of concept maps can provide an avenue to advance critical thinking and incorporate the nursing process. This study also demonstrated that early introduction to concept mapping in the clinical setting can be advantageous to increasing students' critical-thinking ability over time (Abel & Freeze, 2006).

Wilgis and McConnell (2008) investigated concept mapping as a teaching strategy in a hospital orientation program for developing critical thinking and decision-making skills in new graduate nurses. The purpose of this study was to determine whether concept mapping improved critical thinking skills in novice graduate nurses during a hospital orientation program. The framework for the study was Benner's Novice to Expert Theory (Wilgis & McConnell, 2008). The setting took place in a northeast Florida hospital during their orientation program for new graduates. A convenience sample of graduate nurses ($n = 14$), attending the hospital orientation program, were asked to participate in the study. Their ages ranged from 23 to 50 years (mean = 33 yrs).

All but one of the nurses were female, and only one nurse had a completed baccalaureate degree. Of this convenience sample, 64% stated they had no previous nursing experience, and 36% had been a patient care technician prior to becoming a graduate nurse. Although all participants had taken the NCLEX review, only 21% of the new graduates had taken and passed the NCLEX exam (Wilgis & McConnell, 2008).

Participants were asked to use case studies to formulate a concept map of the patient's primary health problem, important assessment findings, applicable nursing diagnoses, and interventions both at the beginning and at the end of the two-day orientation program. At the beginning of the hospital orientation program, the new nurses were given instruction on the construction of a concept map, along with additional information of pathophysiology, physical assessment, and nursing process. The concept maps were scored using the Concept Map Grading Tool. This tool was adapted by the authors to reflect study objectives and the case studies used in formation of the concept maps. This tool was used to assess the nurses' critical thinking and patient care planning skills by incorporating the six American Nurses Association (ANA) standards of nursing care practice of collection of health data, analysis of data to develop nursing diagnoses, identification of expected patient outcomes, development of a plan of care, implementation of nursing interventions, and evaluation of patient progress toward outcomes (Wilgis & McConnell, 2008).

Graduate nurses' improvement of critical thinking skills was evaluated using a descriptive comparison design that examined the differences between the first and the final concept maps from the new nurses. Mean scores were calculated and compared with the final concept map score substantially higher (16.43) than the first concept map score of (14.07). A paired t test showed a significant improvement ($t = -2.797$; $df = 13$; $p = .008$) in final concept maps at a set alpha level of $p = .05$. The total scores for first and final concept maps showed an overall increase of 33 points. There was substantial improvement in areas of graduate nurses' ability to identify primary health problems and indicate appropriate treatments. The comparison of the two maps also showed that the nurses had difficulty with medications and correctly formulating nursing diagnoses, indicating areas for further education (Wilgis & McConnell, 2008).

Concept mapping was found to be an effective tool and teaching strategy in evaluating the thinking skills of new graduate nurses. This method was valuable in progressing the new nurses' ability to synthesize, analyze, and prioritize information pertaining to patient health care and to make appropriate decisions and care plans to address their care. Graduate nurses commented that concept mapping, as a visual format, assisted in putting everything into focus, and was a strong tool for organizing patient care information. It was also concluded by the researchers concept mapping was an inexpensive strategy that could easily be adapted to a hospital orientation program (Wilgis & McConnell, 2008).

Based on the specific needs of nursing education to gain insight into the development of critical thinking in students, August-Brady (2005) investigated the use of concept mapping in relation to the process of learning. The purpose of this study was to examine the effect of a metacognitive intervention, or concept mapping, as an approach to learning and the self-regulation of learning in nursing students. The framework used was the Presage-Process-Product (3P) Model of Teaching and Learning. This conceptual model states that student factors, teaching context, learning-focused activities, and learning outcomes mutually interact. The researchers addressed how students differ in approach to learning and self-regulation with the use of concept maps.

A convenience sample of 80 baccalaureate nursing students from four nursing programs was selected. These participants were divided into a control group ($n = 45$) and a treatment group ($n = 35$). The mean age of the participants was 22.7 ($SD = 5.7$), with the majority (94%) being female. Most of the sample (90%) were full-time students, with a mean grade point average (GPA) of 3.15 ($SD = 0.36$) (August-Brady, 2005).

There were three instruments used in this study. One instrument was the revised Study Process Questionnaire-2 Factor (rSPQ-2F), a 20-item self-report consisting of two parts, a deep approach (DA) and surface approach (SA), that both score on a 5-point Likert scale. A high score on the DA scale indicated that the learner is intrinsically motivated to learn and used assigned strategies to learn in a meaningful manner. A high score on the SA indicated the learner's motivation is extrinsic and approaches learning using strategies such as memorization. The rSPQ-2F showed good factorial validity and

internal consistency in earlier studies, with Cronbach's alpha coefficients of 0.73 (DA) and 0.64 (SA). Another instrument used was the Strategic Flexibility Questionnaire (SFQ), a 21-item self-report scale consisting of three subscales measuring adaptive, inflexible, and irresolute beliefs. Validity was established using factor analysis in a previous study and Cronbach's alpha coefficients were 0.78 (adaptive), 0.81 (inflexible), and 0.79 (irresolute). The third instrument of this study was a researcher-constructed demographic questionnaire (August-Brady, 2005).

Results of the ANCOVA demonstrated that the metacognitive approach (concept mapping) had a significant effect on increasing both the deep approach to learning [$F(1, 72) = 4.34, p = 0.04$] and the adaptive control belief scores [$F(1, 72) = 8.63, p = 0.004$] in the treatment group of students. Paired t tests found no significant differences in inflexible or irresolute control beliefs in either group. In the treatment group, an increase was noted in the adaptive control beliefs ($t = -2.79, df = 34, p = 0.009$) (August-Brady, 2005).

Findings suggested that the metacognitive (concept mapping) approach had an effect on increasing students' approach to learning on a deeper, more meaningful level. These results also suggested that motivated students adapt their learning strategies to the task at hand and concept mapping can provide greater flexibility in control of learning. Researchers concluded that using the metacognitive approach to learning can illustrate the process of critical thought, not just the outcomes of that learning (August-Brady, 2005).

Concept maps have been used in nursing education to interrelate ideas through visual representations and have been shown by earlier studies to provide an innovative teaching strategy. A study by Conceicao and Taylor (2007) investigated the use of concept maps along with reflective journaling in an online course to provide a learning experience that allowed students to integrate content. The purpose of this study was to describe the use of concept maps and self-reflective journaling in an online course to assess students' thinking processes. The purpose of the online course, an elective course called "Distance Education for Adults", was to allow students to analyze concepts, theories, and research on distance education. The framework for this study was the constructivist model of learning, which maintains that knowledge is constructed by the learner (Conceicao & Taylor, 2007).

The sample included 21 nursing students enrolled in the online course. Because this course was an elective and students participating were in different levels of the nursing program, no demographic data was collected. The management system called Desire2Learn (D2L) was used for the course, which was divided into five modules. Students participated in online discussions, created concept maps, and kept reflective journals. The participants were asked to create concept maps at the end of each module depicting their understanding of the readings and online discussions throughout the semester. They also recorded in their reflective journals immediately after creating the concept maps. Methodology data using the software Inspiration and Cmap was collected for the concept maps and journals (Conceicao & Taylor, 2007).

Results of the study focused on three major themes: factors influencing the map creation, developmental learning process over time, and validation of existing knowledge and construction of new knowledge. Three factors influenced how students created their concept maps: personal preference, concept structure, and concept map design. The developmental learning process over time involved three phases: a focus on the relationships between constructs and concepts, a connection between concepts and the readings, and the integration of course concepts. Students experienced these phases on different levels depending on their experience with the use of concept maps. Finally, students described their use of concept maps as validating their existing knowledge bases and useful when constructing new knowledge (Conceicao & Taylor, 2007).

Findings supported the use of concept maps as a teaching strategy to bridge theory and practice as it relates to constructivist learning. Results also concluded that concept mapping was an evidence-based nursing educational strategy. Students using the method of concept mapping and reflective journaling were provided with a reliable pathway to prioritize and organize data for decision-making. Introducing concept mapping early in the educational program was advantageous to improving students' abilities with their critical thinking skills. The researchers concluded concept mapping and reflective journaling show promise in the area of nursing education (Conceicao & Taylor, 2007).

Summary

Critical thinking is recognized as vital to nursing practice. The importance of critical thinking in the nursing profession has been consistently noted by nurse researchers. The literature, however, reveals an inconsistent relationship between the critical thinking of beginning nursing students and graduate nurses. Because beginning nurses have limited experience on which to base decisions, they tend to use concrete thinking and may require explicit guidance in their practice. Expert nurses have more depth of knowledge to be able to consider a situation rapidly, comprehensively, and intuitively.

The National League for Nursing (NLN) has incorporated critical thinking into the outcome criteria for accreditation of nursing educational programs. Most nursing educators are proficient in researching, reviving, and adapting information to meet present criteria. There does exist a gap; however, in the knowledge of faculty to provide experiences that encourage critical thinking in students. Nursing instructors need to be unified in their understanding of critical thinking as a concept, to explore new teaching strategies to present this concept, and also to achieve a consensus about methods and tools to be used for evaluation of critical thinking.

Critical Thinking

Many educational disciplines identify critical thinking as an essential component in the decision making process. There is a consensus among nurse educators to accept

the definition of critical thinking, as presented in Facione's (1990) study, as a nonlinear process of purposeful, self-regulatory judgment that gives reasoned consideration of evidence, contexts, conceptualizations, methods, and criteria. Gordon's (2000) study concluded that although the definition of critical thinking among nurse scholars and non-nurse scholars may be related, nursing has a unique perception of these skills with a focus on analysis, evaluation, and inference.

Assessment of Critical Thinking

Many nurse educators have written about teaching methods that reinforce critical thinking. Nursing faculties generally agree that students who know how to think make better clinical judgments than those who merely memorize facts. Zygmunt and Schaefer (2006) investigated the critical thinking skills of faculty responsible for teaching these skills. The researchers concluded that faculty not well versed in critical thinking ability put students at a disadvantage in developing these skills. Nurse educators could benefit from instruction in creating an atmosphere in the classroom and clinical area where critical thinking is promoted. Twibell et al., (2005) study explored the perceptions of faculty teaching critical thinking skills to undergraduate students and found that nurse educators need to know how to phrase questions to stimulate the higher cognitive processes involved in critical thinking. These researchers described various teaching strategies to address the cognitive skills of critical thinking such as reflection, group discussion, and journaling. Critical thinking may be promoted by these active learning strategies because of their cognitive triggering processes.

A study by McMullen and McMullen (2009) revealed that critical thinking in graduate students is a dynamic and ongoing process, with growth depending on the level of the graduate nurse. These results can assist nurse educators in preparing courses for students at various learning levels. May's et al. study (1999) investigated the relationship between critical thinking and clinical practice. Their findings revealed that critical thinking is a process that may not emerge fully until some experience is garnered in nursing practice. It may be useful to measure the critical thinking skills of graduate nurses at various intervals in their practice careers to ascertain growth and adapt continuing education to these patterns. A study by Rogel and Young (2008) determined that graduate nurses did improve their critical thinking skills with a post-graduation continuing education course given for the critical care area. The researchers suggested that critical thinking may best be viewed as a process that develops over time rather than an end or objective. This study also confirms the need for critical thinking abilities by nurses in complex areas such as critical care units, where considerable amounts of information must be analyzed quickly and decision-making may have serious results.

Critical Thinking and Concept Mapping

Daley's et al. (1999) study described concept mapping as a method for evaluating students' critical thinking abilities. Their findings revealed that this strategy was successful in improving the cognitive ability of students over a semester. Another study by Kostovich et al. (2007) examined

various learning styles and preferences of students with the aptitude for concept mapping. Their results showed that learning style preference does not have any influence in students' ability to accomplish the complex task of concept mapping. This teaching strategy was found to work with all types of learning styles.

Abel and Freeze (2006) study demonstrated that early introduction in the nursing curriculum of the concept map process increased students' critical thinking abilities over time. Research to evaluate serial concept mapping throughout the nursing curriculum would be of value in assessing this particular teaching strategy for improvement of cognitive skills in students. Following this same teaching strategy post-graduation may help graduate nurses in continuing to build their critical thinking abilities. Wilgis and McConnell's (2008) study found concept mapping to be advantageous for new graduate nurses in a hospital orientation program. Using this teaching method helped accelerate nurses' critical thinking process by synthesizing and prioritizing complex information to formulate appropriate nursing decisions. Investigating how this process works was the focus of a study by August-Brady (2005). This researcher found that concept mapping can increase deeper learning, develop more complex thinking, and aid in decision-making for nurses.

With the increase of distance learning and online courses in the nursing curricula, evaluating critical thinking skills in this venue becomes a challenge for nurse educators. Conceicao and Taylor (2007) researched concept mapping and reflective journaling in their study of nursing students enrolled in an online course. Their findings suggest that

concept mapping and reflective journaling hold promise as an effective method for students to organize and prioritize data for decision-making. These two teaching strategies can also be utilized to evaluate the thought processes of students in an online course.

The literature review emphasizes the relevance of critical thinking skills for nurses in the health care setting of today's world. The challenge is for nurse educators to promote critical thinking skills to develop throughout the nursing curriculum. A strategy that is gaining acceptance as an evidence-based teaching method is that of concept mapping. The above studies reveal that concept mapping can improve the development of higher cognitive functioning for students with all learning styles. The concept map is an effective teaching tool, fun, interactive, effective, and used in a variety of settings. The concept map mirrors more closely real clinical situations by being dynamic as priorities shift in the patient arena. It is an innovative teaching tool that engages students and prepares students for future clinical decision-making in a complex and diverse healthcare environment.

Chapter III

Methods and Procedure

Nursing graduates are entering a practice setting filled with increasing patient acuity and changing demands in healthcare. Since the core of nursing practice is the application of knowledge in the clinical setting, it is essential that nursing students be able to link concepts from different areas of their knowledge base. The interrelationships of knowledge, critical thinking skills, and clinical nursing practice have become a priority and a challenge for nurse educators to address these needs. The challenge for nurse educators is how to better organize instructional materials to assist students in assimilating their knowledge. Concept mapping is an effective teaching strategy and has gained attention in recent literature as an outcome measure of critical thinking in nursing education. This teaching approach can support nursing educators in arriving at appropriate ways to foster critical thinking in students that can improve their academic success. The purpose of this study was to evaluate the use of concepts maps as a teaching technique that illustrates the progression of clinical judgment and critical thinking skills in undergraduate nursing students in a critical care course using case study scenarios. This study was a modified replication of Wilgis's (2008) study. This chapter includes information about the population, sample, procedure, measurement, methodology, and design used to guide this study.

Research Questions

1. Is concept mapping effective as a teaching tool in developing critical thinking over a semester in undergraduate nursing students enrolled in a psychiatric nursing course?
2. Is concept mapping an effective analytical tool to help nursing students prioritize, synthesize, and organize data in a logical manner to enhance critical thinking?

Population, Sample and Setting

A convenience sample of thirty-six students ($n = 36$) enrolled in a 2-year associate degree nursing program in the Midwest were invited to participate in this study. Students who participated in the research study were admitted to the school of nursing based on their grade point average (GPA) and four specified pre-nursing general education courses. The participants were all in their third semester (second level) of the nursing program and had completed the Fundamentals of Nursing and the Medical - Surgical Nursing I courses. Demographic data collected will include age, sex, and educational level.

Protection of Human Rights

This study will be submitted to the Ball State University Institutional Review Board (IRB) and Ivy Tech Community College Nursing Administration for approval prior to conduction. Ethical consideration will be given attention for this study by adhering to ethical principles for research. No risks have been identified within

the study. Voluntary participation along with the right of participants to refuse any part of the study will be explained thoroughly.

Procedures

The participants in this study will be enrolled in the second level psychiatric nursing course (NRS 204). The students will be given overall instructions on the methodology of constructing a concept map. A series of five case studies will be presented on various disorders addressed throughout this semester course. The students will be assigned to use these case studies to create a concept map of the patient's main physiological and/or psychological health problem, key assessment data, priority nursing diagnoses, nursing goals, and appropriate nursing interventions in hierarchical and logical order. A grading rubric was adapted based on Schuster's (2002) instrument for grading criteria. Grades from the five concept maps completed by the students will be evaluated to show progression in critical thinking skills. Demographic questionnaires, including age, sex, and GPA, will be completed by the participants of this study.

Research Design

This study used a descriptive comparison design to evaluate students' concept mapping skills over the course of a semester. A descriptive design is appropriate to determine the baseline performance of students in using certain teaching strategies, exploring perceptions about critical thinking and the teaching strategy of concept mapping, and the effectiveness of this teaching strategy. The comparative descriptive design will examine differences in the initial and final concept maps produced by the

participants in this study. The results obtained may be of value in determining the efficacy of this particular teaching strategy in promoting critical thinking abilities among nursing students.

Instrumentation, reliability and validity

The rubric used to evaluate and score the concept maps completed by nursing students was adapted from the instrument developed by Schuster (2002). This grading tool has the essential elements to assess nurses' critical thinking abilities based on the American Nurses Association (2003) standards of care practice, which include collection of data, analysis of data to determine nursing diagnoses, identification of expected patient outcomes, development of a plan of care, implementation of nursing interventions, and evaluation of patient progress toward expected outcomes. Schuster (2002) reported that concept map care plans for clinical evaluations of critical thinking are reliable ($r = 0.70$ or higher) if the same faculty taught and graded the maps. This study includes consistency in the faculty to ensure the reliability of the scoring procedures.

Measures of Data Analysis

Descriptive analysis will be used to determine the total scores for a comparison of the initial concept maps and progressive ones. Mean scores for the initial and final concept maps will be calculated and compared. Individual scores will also be evaluated to determine areas needing re-learning. A paired t test will be analyzed for significant improvement in critical thinking ability with a set alpha level of $p = .05$ (Wilgis & McConnell, 2008).

Summary

In this chapter, the methods and procedures for this study are described. The main variables to be analyzed are critical thinking skills and the teaching strategy of concept mapping. A descriptive comparison design study will be used with a convenience sample of second-level nursing students in a psychiatric nursing semester course. Data will be collected using an adapted rubric from Schuster's (2002) instrument for scoring concept maps. Descriptive analysis will be performed at the significance level of 0.05. This study is a partial replication of Wilgis and McConnell's (2008) study on concept mapping. The findings will attempt to validate the previous results in the above study in recommending the teaching strategy of concept mapping to improve students' critical thinking skills.

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Source	Problem	Purpose/ Research Questions	Framework or Concepts	Sample	Design	Instruments	Results	Implications
(Gordon, 2000)	Nursing has debated the definitions of critical thinking and clinical judgment for over a quarter of a century; congruency is needed to assist nursing educators in measuring these concepts.	To compare the definitions of critical thinking by nurse educators and non-nurse educators; and to compare their perceptions of the definitions to the literature.	Facione Delphi study (1990) consensus statement on critical thinking.	Cluster sampling of 201 baccalaureate nurse educators.	Descriptive design in this exploratory study.	Researcher developed questionnaire of 12 demographic questions and 4 subsections. Content validity established; reliability assessed by test-retest method.	Nurse educators were less likely ($p<0.05$) than non-nurse educators to consider skills such as interpretation, explanation, and self-regulation as critical thinking; they were more likely ($p<0.01$) to identify problem-solving, researching, and decision-making as part of critical thinking.	Nurse educators viewed critical thinking as abstract, a step-by-step process similar to problem-solving as described in the literature. Also viewed as congruent with nursing process. This is a different conception from educators in other disciplines.

Source	Problem	Purpose/ Research Questions	Framework or Concepts	Sample	Design	Instruments	Results	Implications
(Zygmunt & Schaefer, 2006)	The exact nature of the relationship between nursing education, clinical practice, and critical thinking (CT) is unclear. It is suggested that education is primarily responsible for providing CT skills, however, work experience and mentoring may be required for CT development.	To determine the CT skills of nursing faculty and to examine the relationship between epistemological position and critical thinking.	Critical thinking definition by Facione (1998). Assumptions used for this study include: there is a relationship between CT skills of faculty and student achievement of CT; and the epistemological position of an individual is related to the ability to think critically.	Random national sample of 300 nursing faculty from NLN member schools.	Descriptive correlation design. Data triangulation by use of qualitative and quantitative methods.	CCTST (California Critical Thinking Skills Test); 34 item multiple-choice measures CT ability. Reliability coefficient was 0.86; content, construct validity established. LEP (Learning Environment Preferences); 65 item test - 5 domains; Cronbach's alpha for each domain ranged from 0.63 to 0.84; construct	CCTST showed variability of faculty CT ability, mean score 19.14 (SD = 6.76). Low negative correlation between faculty age and evaluation ($r = -.289, p < .04$). LEP showed negative correlation between years of graduate teaching ($r = -.389, p < .01$) and education in CT ($r = -.292, p < .04$).	Critical thinking may be an ongoing process that requires experience besides education. Students being taught by faculty not familiar with CT skills may be at a disadvantage. There is a relationship between faculty teaching CT skills and the student achievement of this ability. Creating an environment for inquisitive thinking is recommended.

Source	Problem	Purpose/ Research Questions	Framework or Concepts	Sample	Design	Instruments	Results	Implications
						validity established.		
(Twibell, Ryan, & Hermiz, 2005)	Nursing instructors perceive that they teach critical thinking skills through a number of approaches; a clearer definition of critical thinking is needed along with strategies to teach this skill.	To explore perceptions of nursing faculty teaching critical thinking skills to baccalaureate Nursing students in clinical settings.	Conceptualized critical thinking (Bandman and Bandman 1995). Case study method (Merriam 1998). Alfaro-LeFevre (1999) definition of critical thinking.	Convenience sample consisted of six clinical nursing instructors.	Ethnographic qualitative design.	Interviews with instructors three times during one semester at 2-week intervals after a clinical experience.	Five domains emerged from the data analysis: putting it all together, strategies to promote critical thinking, role of instructors, beneficial characteristics of instructors, and rewards of critical thinking.	In development of critical thinking, instructors need to know how to pose questions to stimulate higher-order cognitive processes. Reflection, group discussion, and journaling can be a worthy approach to this goal.
(McMullen & McMullen, 2009)	Critical thinking has mainly been explored in undergraduate nursing education;	To investigate how critical thinking skills change during a 2-year graduate nurse program.	Critical thinking definition (Facione, 1990).	Successive independent sample of 82 nursing students entering a 2-year graduate	Descriptive statistical design.	California Critical Thinking Skills Test (CCTST), a 34 item multiple-	Total CT at higher initial levels at program entry has slight increase (< 6%) in	Findings in study indicate change in CT skill levels during 2-year graduate program

Source	Problem	Purpose/ Research Questions	Framework or Concepts	Sample	Design	Instruments	Results	Implications
	little is known about the CT skills in graduate students.		Individual growth model	NP program, drawn from 3 successive classes.		choice that measures CT ability and has 3 CT subscales: evaluation, inference, and analysis. Construct & content validity based on Delphi study (Facione, 1990); Kuder-Richardson 20 internal reliability 0.68-0.70	evaluation skills; lower initial levels at program entry had 54% increase in evaluation skills. Difference in inference scores from program entry was 0.5 point to end of program. Difference in analysis scores from program entry to end was 1 point.	more dynamic than expected. CT skills varied on increase depending on level of skill students bring on entry to the program. Students measuring lower on CT skills at entry benefitted most at end of program. Ability to differentiate patterns of growth at various levels helps educators to individualize educational courses to meet student needs.

Source	Problem	Purpose/ Research Questions	Framework or Concepts	Sample	Design	Instruments	Results	Implications
(May, Edell, Butell, Doughty, & Langford, 1999)	Nursing's challenge is to define and measure critical thinking and clinical competence. It seems that competent practice depends on critical thinking skills; this study sets out to test this relationship.	To describe one school of nursing's response to the challenge of defining and measuring critical thinking and clinical competence and to examine this relationship.	Critical Thinking Clinical Competence Cognitive Skills Decision-Making Skills Benner (1984)	Convenience sample of 143 senior students enrolled in a BSN program.	Nonexperimental design Descriptive and exploratory in nature.	CCTCST: A 34-item tool which tests cognitive skills. CCTDI: A 75-item tool which tests seven dispositions of critical thinking. Cronbach's alpha reliability is .70 for this tool.	No statistically significant correlations between critical thinking and clinical competence total scores. Mean scores for CCTDI were 311; above established mean scores. Mean scores for CCTCST were 16.76; above established mean score of 15.89.	Critical Thinking may not emerge as an associated factor with clinical competence until some time after nursing students become practicing nurses. May be more useful to study this relationship six months after graduation.

Source	Problem	Purpose/ Research Questions	Framework or Concepts	Sample	Design	Instruments	Results	Implications
(Rogel & Young, 2008)	Critical care nurses process copious information and must make decisions quickly with considering more than one possibility. Critical thinking skills must be well-developed to make these clinical decisions.	To determine if critical thinking skills of nurses enrolled in a post-graduate critical care course improved over time.	Not available.	A convenience sample of 31 registered nurses enrolled in a 12-month critical care post-graduate course seeking to specialize in critical care nursing.=	Small pilot longitudinal study using pretest – posttest format, completing a self-administered test.	The test used was the California Critical Thinking Skills Test (CCTST).	Mean critical-thinking scores for total group improved slightly over time, with mean pretest score of 18.5 and mean posttest score of 19.7 , both scores higher than established norms for this test. No significant difference b/t pretest and posttest; slight improvement noted for nurses whose scores improved (p < .000).	Critical thinking is best viewed as a process rather than an end or objective. Development of critical thinking is complex and demonstrated in clinical settings as well as classrooms. Nurses demonstrating effective critical thinking are well positioned to provide advanced critical nursing care, which benefits both patients and institutions.

Source	Problem	Purpose/ Research Questions	Framework or Concepts	Sample	Design	Instruments	Results	Implications
(Daley, Shaw, Balistrieri, Piacentine, 1999)	A concern among nursing educators relates to effective methods to evaluate students' critical thinking abilities.	To describe a study that used concept maps as a method to teach and evaluate critical thinking in nursing students.	Ausubel, Novak, Hanesian's (1986) assimilation theory of learning. APA (1990) definition of critical thinking.	Convenience sample of six senior nursing student clinical groups (n = 54).	Descriptive design.	Concept maps created by the authors. Scoring formulas was based on assimilation theory. Reliability established by two independent scores on each map; content validity validated by two researchers.	Mean group scores on first concept map was 40.38; final map mean was 135.55; difference of 98.16. The t value was -5.69 (p = .001).	This study showed a statistically significant difference between the first and final concept maps constructed by the students; indicative of an increase of conceptual and critical thinking abilities. Concept maps can provide an excellent teaching strategy to improve and evaluate cognitive skills in nursing students.

Source	Problem	Purpose/ Research Questions	Framework or Concepts	Sample	Design	Instruments	Results	Implications
(Kostovich, Poradzisz, Wood, O'Brien< 2007)	Nursing educators acknowledge various learning styles among students in acquiring information and transforming it into meaningful concepts for their nursing practice. Multiple and innovative approaches are necessary to achieve this goal; concept mapping may be one approach.	To describe the relationship between nursing students' learning style preference and aptitude for concept maps.	Ausubel, Novak, Hanesian's (1986) assimilation theory of learning. Kolb (1985) matrix of learning styles (accommodator, diverger, converger, and assimilator).	Convenience sample of 120 nursing students in the second semester of junior year, enrolled in the adult medical-surgical nursing course.	Correlational descriptive design. Quantitative and qualitative analysis.	LSS (Learning Style Survey), adaptation of Kolb's (1976) LSI (Learning Style Inventory); consists of nine sets of statements to identify learning style as concrete, active, abstract, or reflective. No reliability or validity found in literature for this instrument. A nine open-ended	Mean score for the AE (active experimentation) subscale 17.33 (SD = 3.09) and was significantly higher ($p < 0.001$) than the other subscales. Concept map and final course grades were weakly correlated ($r = 0.37, p < 0.01$). Survey questions found no relationship between learning preference and survey comments.	This study's findings indicate that learning style preference does not have any influence in students' ability to perform well on concept maps. Concept mapping as a complex learning strategy can be effective in developing students' critical thinking skills and works with all types of learning styles.

Source	Problem	Purpose/ Research Questions	Framework or Concepts	Sample	Design	Instruments	Results	Implications
						questionnaire developed by researchers related to creating of concept maps. Test-retest reliability conducted at semester end.		
(Abel, Freeze, 2006)	The challenge for nursing educators is to define and measure critical thinking skills that lead to clinical competence. There is a need to evaluate teaching	To evaluate concept mapping as a clinical teaching-learning activity that reflects critical thinking by promoting identification of nonlinear relationships among the components of the	APA (1990) definition of critical thinking. Daley's (1999) application of theoretical knowledge into clinical practice.	Convenience sample of 28 associate degree nursing students from the same graduating class.	Descriptive design.	Scoring of the concept maps was the same as Daley's (1999) study; including propositions, hierarchy, cross-links, and examples. Reliability (interrater) established in pilot study;	Mean concept map scores increased each semester (173 for first semester and 249 for last semester). Paired <i>t</i> test was -4.75 , critical <i>t</i> value with 27 df was 1.70 ($p = 0.05$), indicating a statistically significant difference between scores for the first and	Early introduction of the concept map teaching strategy is advantageous in developing and increasing students' critical thinking skills over time. This study supports concept mapping as an evidenced-

Source	Problem	Purpose/ Research Questions	Framework or Concepts	Sample	Design	Instruments	Results	Implications
	strategies in the nursing curricula.	nursing process.				intrarater reliability determined by random selection of 2 maps previously scored and then rescored by instructor. Content validity established by Daley (1999).	last concept maps.	based teaching strategy in nursing education.
(Wilgis, McConnell, 2008)	New graduate nurses are expected to recognize emerging problems in their patients and to use critical thinking skills to appropriately intervene.	To investigate whether concept mapping is useful in developing critical thinking in graduate nurses during a hospital orientation program.	Benner's (1984) Novice to Expert Theory.	Small convenience sample of 14 graduate nurses attending a hospital orientation program.	Descriptive comparison design; pre- and post-concept maps differences will be examined.	Schuster's (2002) Concept Map Care Plan Evaluation Tool (adapted by the authors to reflect program objectives and case	Total scores for the first and final concept maps showed an increase of 33 points. Mean scores were substantially higher for the final concept map (16.43) when compared	Concept mapping was found to be a useful strategy in evaluating graduate nurses' thought processes. Usage of this teaching method accelerated the nurses' critical thinking by

Source	Problem	Purpose/ Research Questions	Framework or Concepts	Sample	Design	Instruments	Results	Implications
	These abilities may not be well developed in the new graduate nurse and could affect patient outcomes.					studies). Reliability reported as ($r = 0.07$ or higher) if same faculty teaching the course are grading the maps, which was the case in this study.	to the first map (14.07). Paired t test showed significant improvement ($t = -2.797$; $df = 13$; $p = .008$); in post concept maps at a set alpha level of $p = .05$.	formulate a synthesizing and prioritizing information to appropriate nursing interventions.
(August-Brady, 2005)	Little empirical support exists in nursing education literature related to the process of learning. Nursing education needs specific	To examine the effect of a metacognitive intervention (concept mapping) on approach to learning and self-regulation of learning in baccalaureate nursing students.	Presage-Process-Product (3P) Model of Teaching and Learning (Biggs, Kemper, & Leung, 2001)	Convenience sample of 80 baccalaureate nursing students from four accredited nursing programs in eastern Pennsylvania. Treatment group ($n = 35$); control	Quasi-experimental design. Pre-test – post-test.	Revised Study Process Questionnaire – 2 Factor: good factorial validity and internal consistency (Biggs et al., 2001); Cronbach's alpha 0.82 (DA) and 0.70 (SA).	Paired t tests: no significant difference in treatment group in deep approach or surface approach to learning; statistically significant differences in control group in deep	A significant effect was found for using concept mapping to increase the deeper learning approach and flexibility in control of that learning for students. CM can help

Source	Problem	Purpose/ Research Questions	Framework or Concepts	Sample	Design	Instruments	Results	Implications
	insight into the development of critical thinking and the student approach to learning.			group (n = 45).		Strategic Flexibility Questionnaire (SFQ): validity established by factor analysis; Cronbach's alpha 0.71 (adaptive, 0.80 (inflexible), 0.78 (irresolute) in this study. Researcher-constructed demographic questionnaire.	approach and surface approach to learning. No significant difference found in inflexible and irresolute control beliefs in either group. ANCOVAs: statistically significant differences found for adaptive control belief subscale in treatment group.	develop learners capable of more complex thinking and decision making.
(Conceicao & Taylor, 2007)	Concept maps have been used as educational tools since the 1980s, but there is	To describe the use of concept maps and self-reflective journaling in assessing	Constructivist model of learning.	21 nursing students enrolled in an online nursing course, collected	Longitudinal, descriptive, qualitative design.	Software programs: Inspiration and Concept map tools. Concept maps graded	Three themes emerged: 1. factors influencing map creation – personal preference,	Findings suggest the use of concept maps and reflective journaling

Source	Problem	Purpose/ Research Questions	Framework or Concepts	Sample	Design	Instruments	Results	Implications
	limited research on their use in nursing education as a learning tool and evaluation tool.	students' thinking processes.		over 2 semesters.		on proposition, hierarchy, cross-links; journal guided by relationships among concepts.	concept structure, and design; 2. developmental learning process over time; and 3. validation of existing knowledge and construction of new knowledge.	holds promise for nursing education as a quick method for students to prioritize and organize data for decision-making. New strategies such as these can be utilized to assess student cognitive progress in an online nursing course.